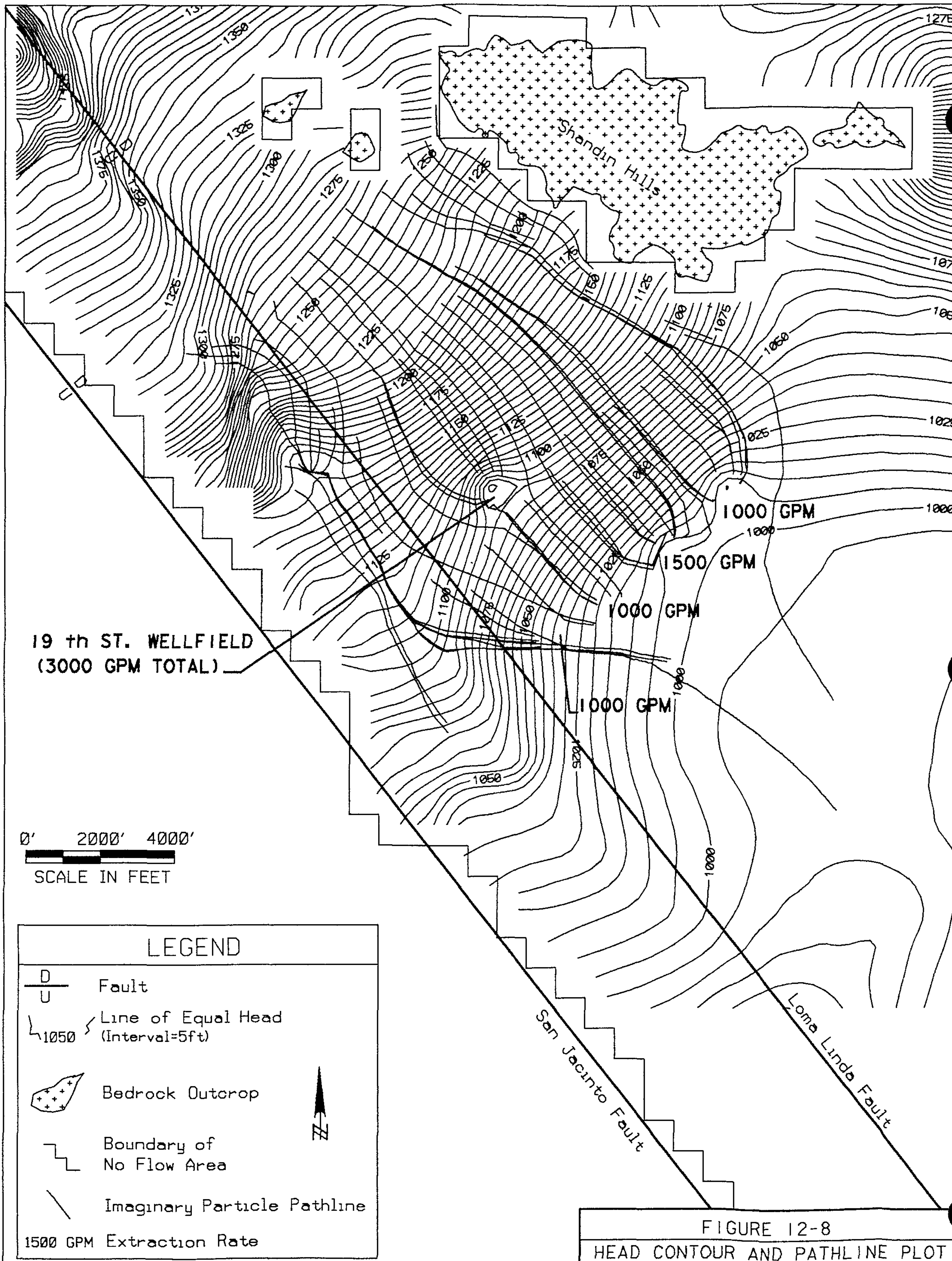

FIGURE 12-8

HEAD CONTOUR AND PATHLINE PLOT FOR EXTRACTION SCENARIO NO. 5 LAYER 1 (UPPER AQUIFER)

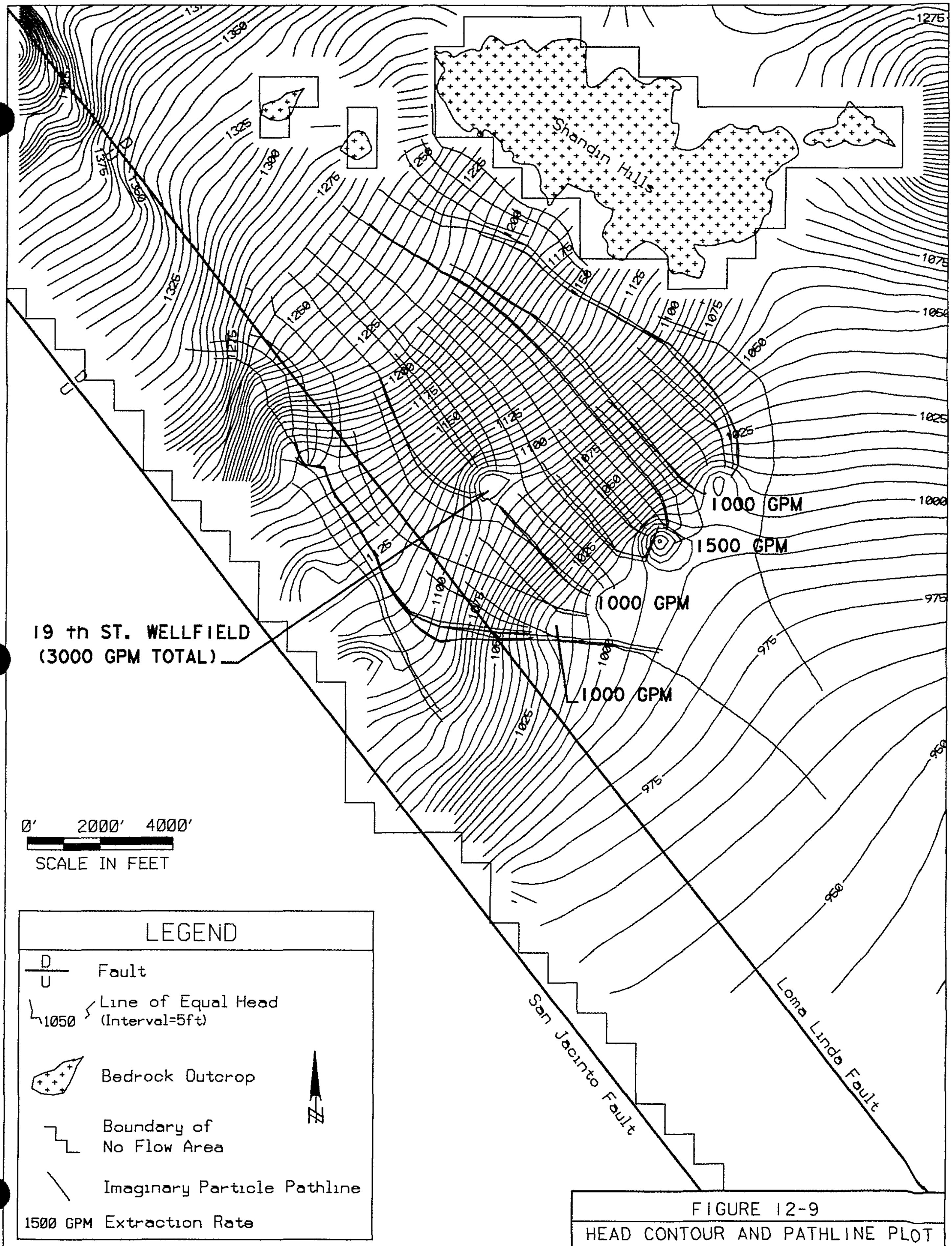

FIGURE 12-9
HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 5
LAYER 2 (LOWER AQUIFER)

Extraction Scenario No. 6

This extraction scenario consisted of four extraction areas located near the downgradient edge of the plume. The extraction in the four extraction areas was as follows:

- No pumping the first 5-year period; and
- For the next 30 years, constant daily pumping of 1500, 1500, 1700, and 1500 gpm from the four extraction areas.

The 19th Street wellfield was pumped only during the first 5-year period at normal pumping rates, and no pumping was assumed during the following 30 years.

Figures 12-10 and 12-11 show the head contours and pathlines of imaginary particles for layers 1 and 2, respectively. All the imaginary particles were captured by the extraction areas.

Extraction Scenario No. 7

This extraction scenario consisted of four extraction areas located in the downgradient edge of the plume and the Baseline Feeder wellfield. The extraction in the four extraction areas was as follows:

- No pumping the first 5-year period; and
- For the next 30 years, constant daily pumping of 1500, 1500, 1700 and 1500 gpm from the four extraction areas.

The Baseline Feeder wellfield was turned on from January 1991, and normal pumping rates were used for the 3-year period starting from January 1991 through December 1993. For the remainder of the simulation period, starting from January 1994, the yearly pumping rate used in 1993 was repeated for the Baseline Feeder wellfield. The 19th Street wellfield was pumped only during the first 5-year period at normal pumping rate, and no pumping was assumed during the following 30 years.

Figures 12-12 and 12-13 show the head contours and pathlines of the imaginary particles for layers 1 and 2, respectively. All the imaginary particles were captured by the four extraction areas. It appeared that the pumping of the Baseline Feeder wellfield did not affect the capture of imaginary particles by the four extraction areas.

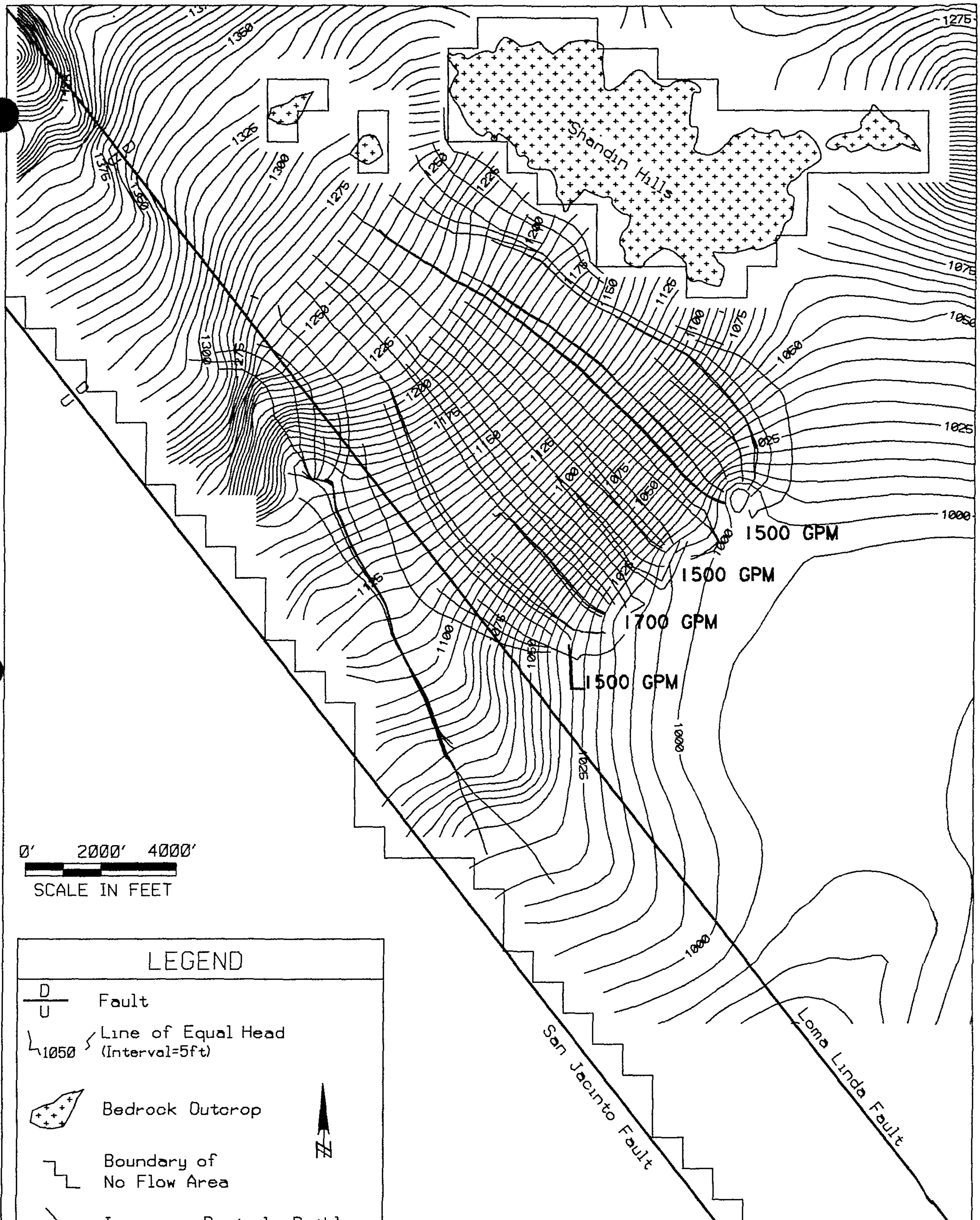

FIGURE 12-10

HEAD CONTOUR AND PATHLINE PLOT FOR EXTRACTION SCENARIO NO. 6 LAYER I (UPPER AQUIFER)

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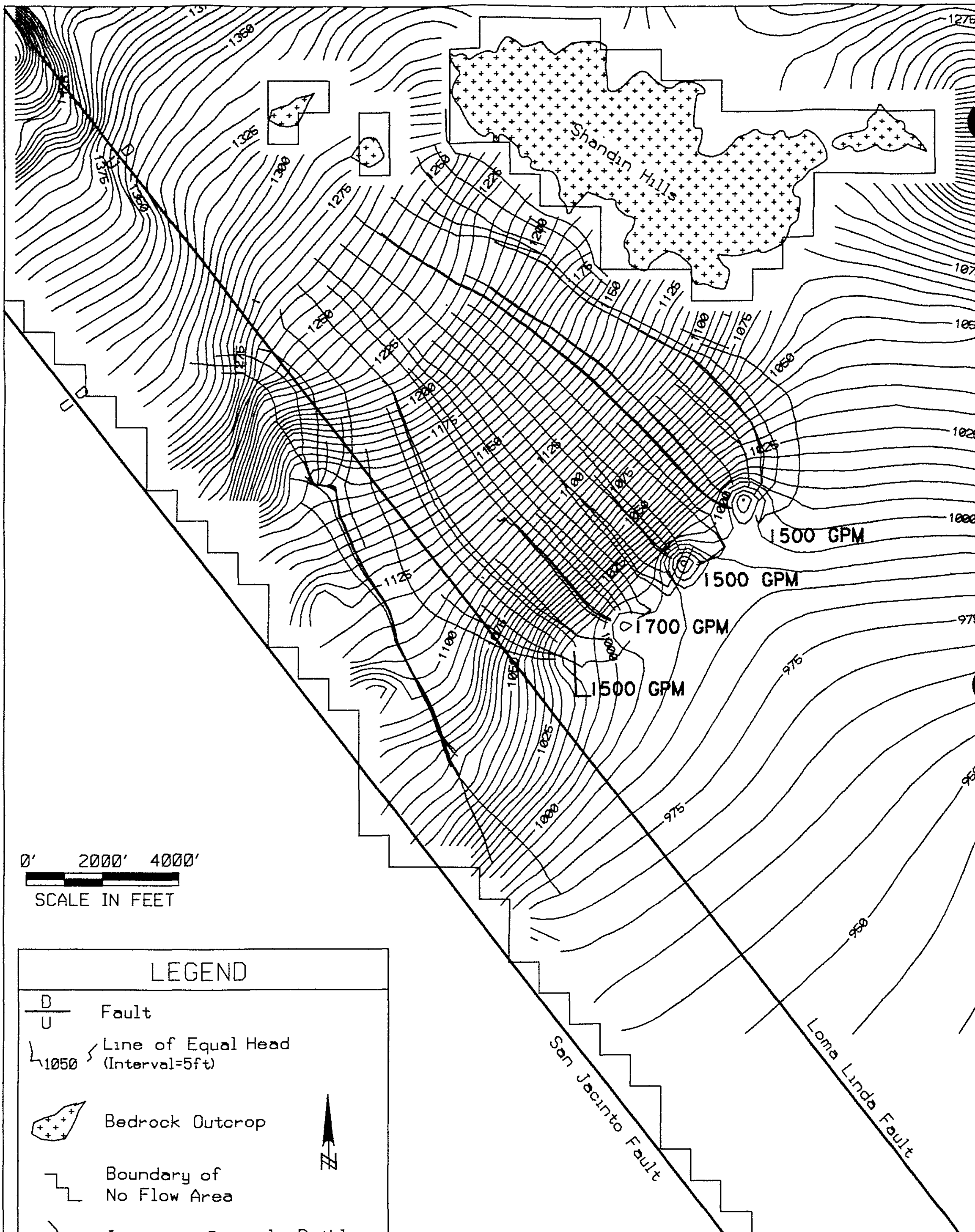

FIGURE 12-11

HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 6
LAYER 2 (LOWER AQUIFER)

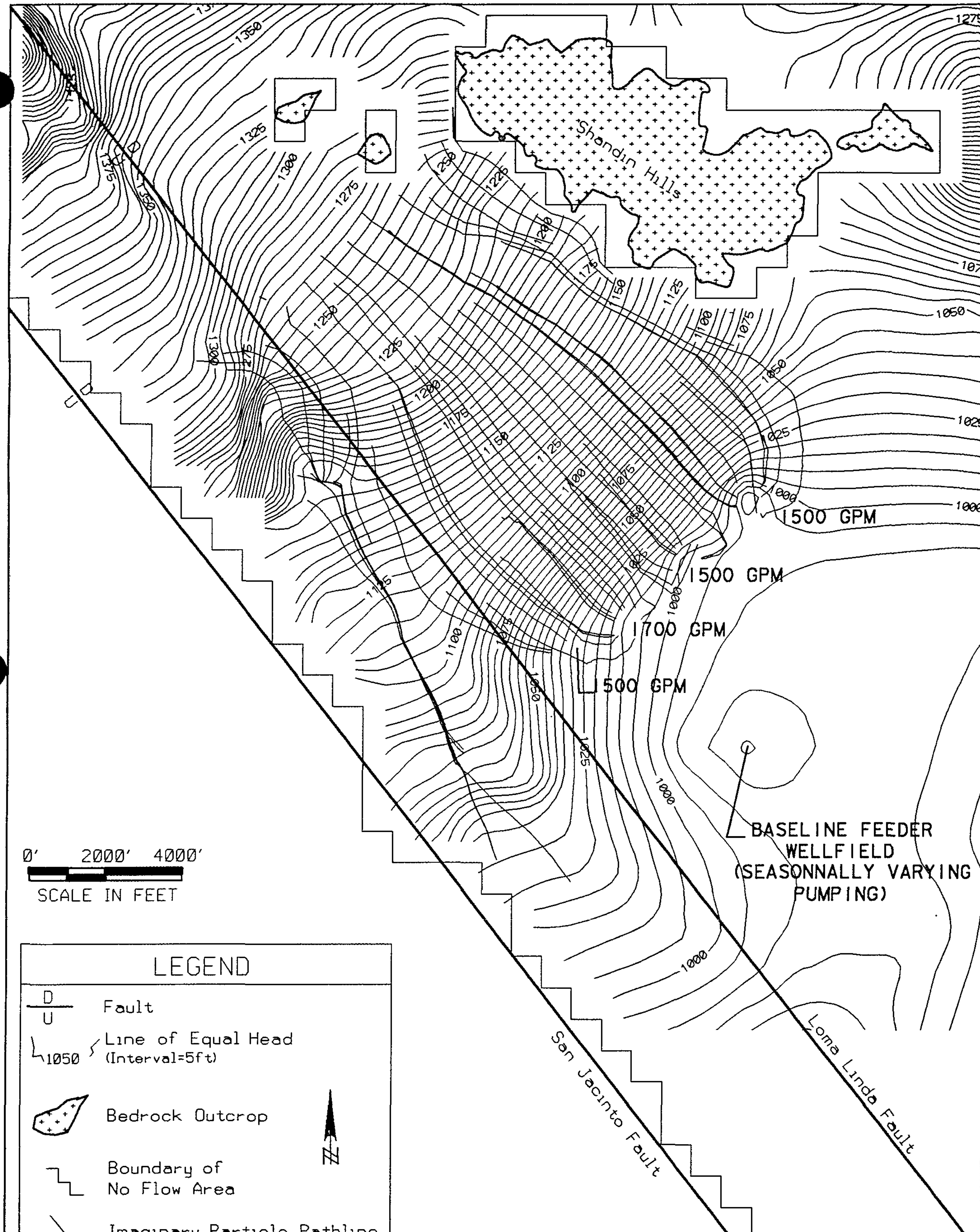

FIGURE 12-12
HEAD CONTOUR AND PATHLINE PLOT FOR EXTRACTION SCENARIO NO. 7 LAYER 1 (UPPER AQUIFER)

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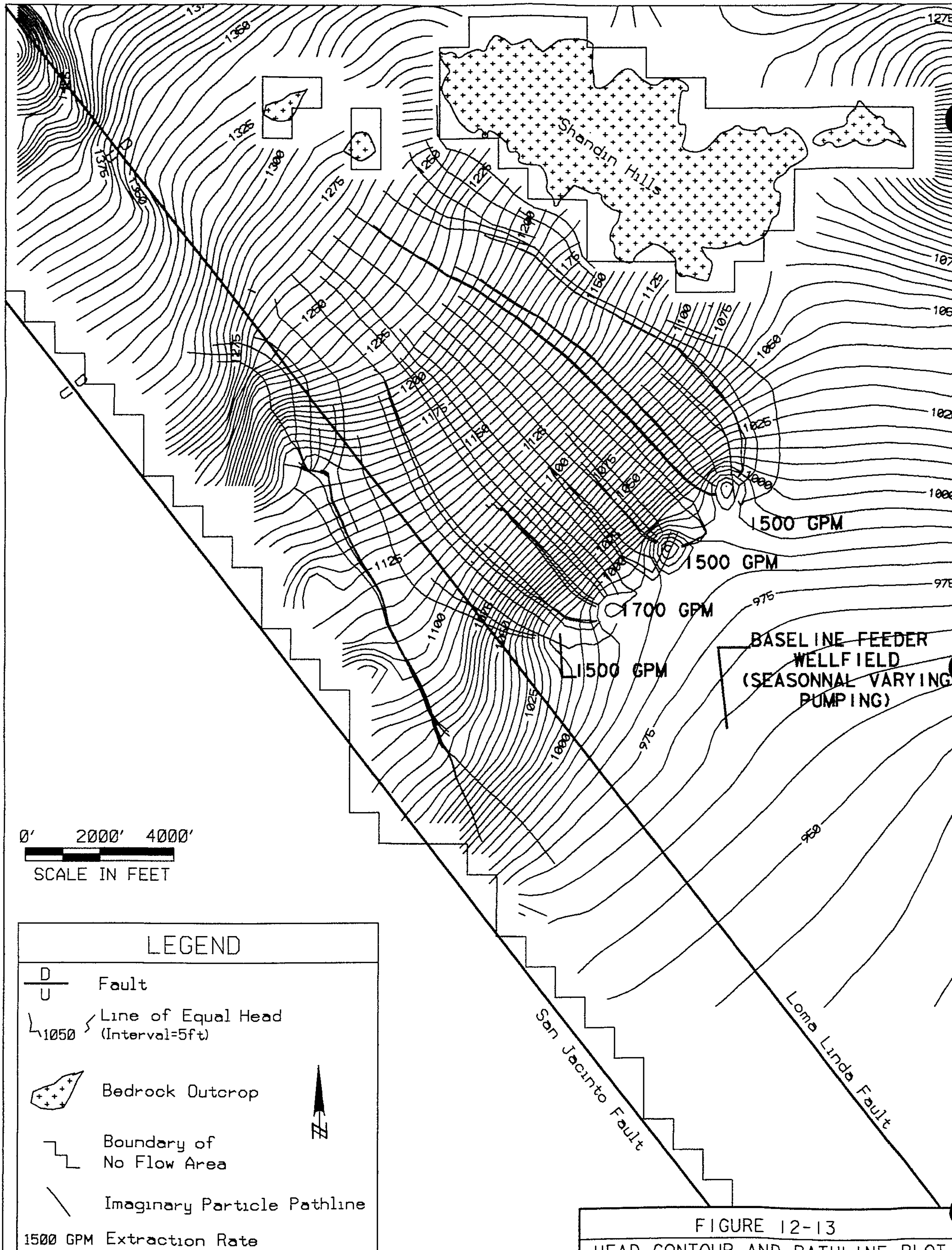

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FIGURE 12-13

HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 7
LAYER 2 (LOWER AQUIFER)

Extraction Scenario No. 8

This extraction scenario was identical to extraction scenario no. 7 except that pumping in the four extraction areas was changed to each quarter-year to simulate the seasonal water demand on the municipal supply system. This scenario consisted of four extraction areas located near the downgradient edge of the plume and Baseline Feeder wellfield. The extraction in the four areas was as follows:

- No pumping the first 5-year period; and

- For the next 30 years, a changing pumping rate to reflect the seasonal variation (or changing water demand) was used.

Based on the 3-year period between January 1991 through December 1993, the pumping history of Baseline Feeder wellfield (data provided by the SBVMWD) showed maximum pumping occurs in the 4th quarter. During the 1st, 2nd, and 3rd quarters, the pumping rates were 0.69, 0.64, and 0.9 times the 4th quarter pumping rate, respectively. These ratios were used to simulate the pumping from the four extraction areas for each quarter in a year with maximum pumping of 1500, 1500, 1700, and 1500 gpm in the 4th quarter. Thus, this one-year pumping cycle from the 4 extraction areas was repeated for the 30-year simulation period.

The Baseline Feeder wellfield was turned on from January 1991, and actual pumping rates were used for the 3-year period starting between January 1991 through December 1993. For the remainder of the simulation period, starting January 1994, the actual yearly pumping rate of 1993 was repeated. The 19th Street wellfield pumped only during the first 5-year period at normal pumping rates, and no pumping was assumed during the following 30-year period.

Figures 12-14 and 12-15 show the head contours and pathlines of the imaginary particles for layers 1 and 2, respectively. Most of the imaginary particles were captured by the four extraction areas. One particle south of and one particle north of the four extraction areas were not captured. Also, one particle escaped capture through the space between two of the four extraction areas.

Extraction Scenario No. 9

This extraction scenario consisted of four extraction areas located in the downgradient edge of the plume. The extraction in the four extraction areas was as follows:

- No pumping the first 5-year period; and

- For the next 30 years, constant daily pumping of 1500, 1500, 1700, and 1500 gpm from the four extraction areas.

The 19th Street wellfield was pumped only during the first 5-year period at normal pumping rates, and no pumping was assumed during the following 30-year period.

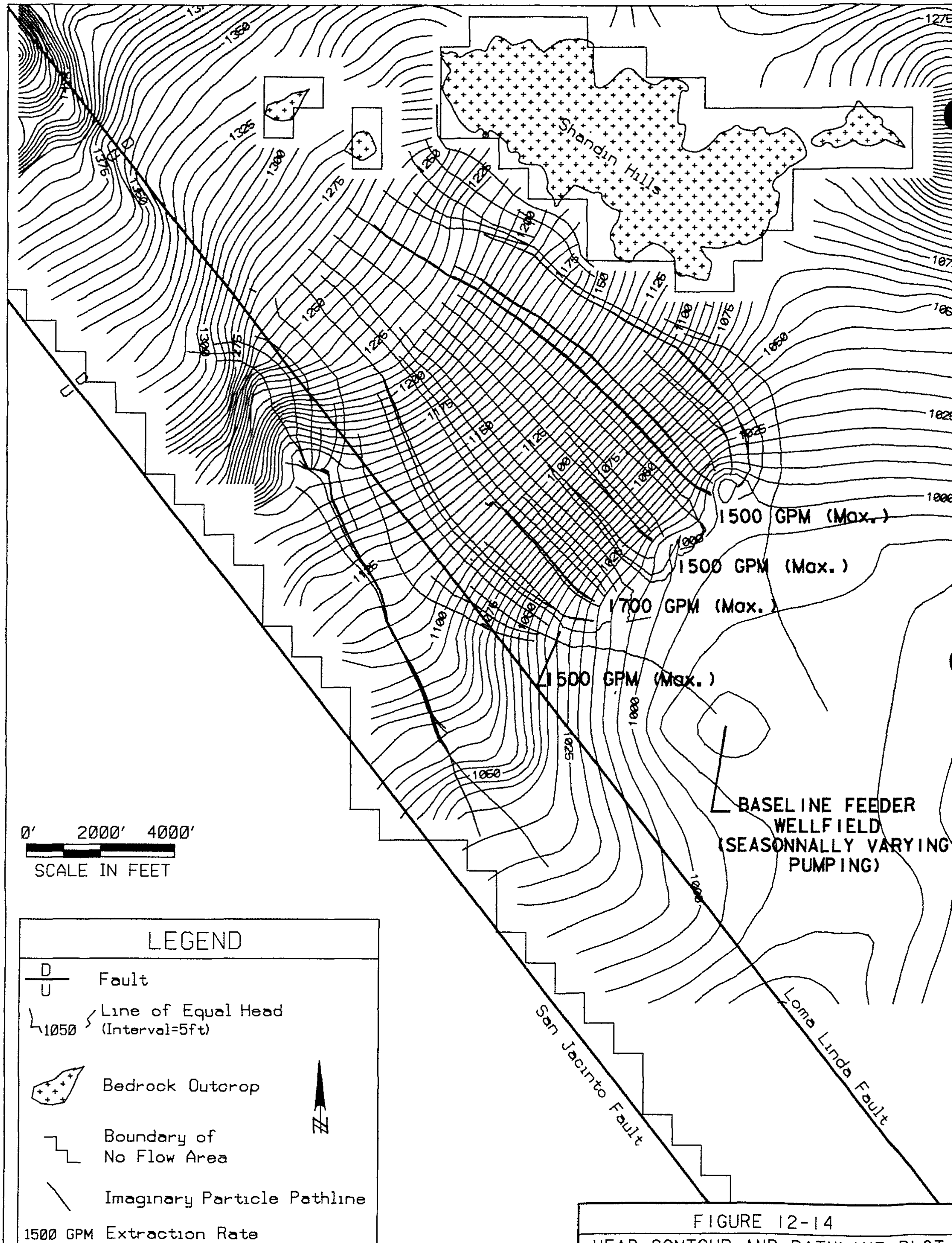

FIGURE 12-14
HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 8
LAYER 1 (UPPER AQUIFER)

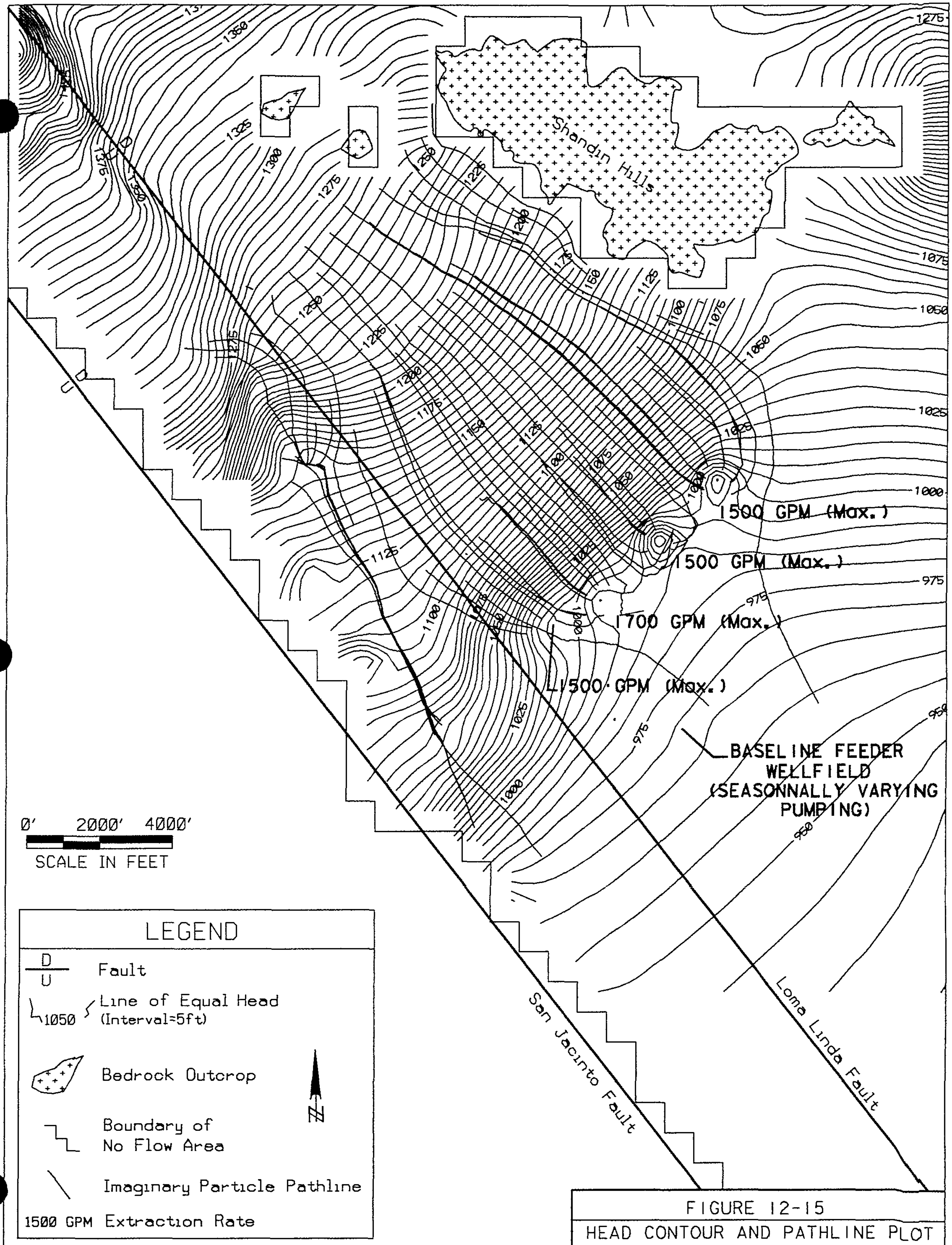

FIGURE 12-15
HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 8
LAYER 2 (LOWER AQUIFER)

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As described in Subsection 12.1.2, two injection well regions were considered as shown in Figure 12-1: one region located adjacent to the eastern boundary of the plume, and the second region located adjacent to the western boundary of the plume. In each of these injection regions, 4 injection areas were considered. Consequently, a total of 8 injection areas each with an injection capacity of 775 gpm (=6200/8) were considered for reinjection. It was assumed that the injection wells are suspended in the upper and lower layers of the aquifer. Several simulation runs were made to select the location of injection areas before arriving at this final simulation.

Figures 12-16 and 12-17 show the head contours and pathlines of imaginary particles for layers 1 and 2, respectively. All the imaginary particles were captured by the extraction areas.

It should be noted that a main purpose for considering groundwater injection was for an end-use alternative. Injection scenarios were not optimized during the current modeling effort. If the injection end use alternative becomes part of the selected remedy, additional evaluation to optimize injection well locations and injection rates must be performed.

Table 12-1 provides a summary of the parameters used in the nine extraction scenarios.

12.1.4 Preferred Extraction Scenario

The nine extraction scenarios were evaluated for their ability to capture imaginary particles. Based on this evaluation, extraction scenario no. 6 was chosen as the preferred scenario. Extraction scenario no. 6 corresponds to predictive model run 59J. This scenario involved four new extraction areas with a total pumping rate of 6,200 gpm. It should be noted that this pumping rate is an estimate based on model results and is, therefore, subject to the same degree of uncertainty as the model. Pumping rates for the extraction system should be determined after the new wells are constructed and tested. Regardless, the rate chosen here is considered adequate for FS purposes. The effects of pumping 19th Street wells or the Baseline Feeder wells (either beneficial or detrimental) could not be firmly established with the current information. It is evident that the most effective extraction remedy requires extraction of approximately 6,200 gpm in a series of new wells at the leading edge of the plume. The 6,200 gpm estimate should be considered the starting point for a refined model estimate developed from additional observations of the aquifer during the RD phase. For preliminary engineering calculations, a conservative estimate of approximately 7,000 gpm should be used. An extraction rate of 4,000 gpm (Scenario 3), appeared to be quite inadequate and several particle pathlines were not captured at extraction rates between 5,000 and 6,000 gpm. It may be possible that a more refined model based on additional site-specific observations could produce an estimated extraction rate in the 5,000 gpm range. Additionally, information was insufficient to predict the effects of seasonal differences in pumping rates.

Extraction scenario no. 9, as previously mentioned, was evaluated for an end-use alternative. This scenario is used in Subsection 13.1.5 during detailed analysis of remedial Alternative 5.

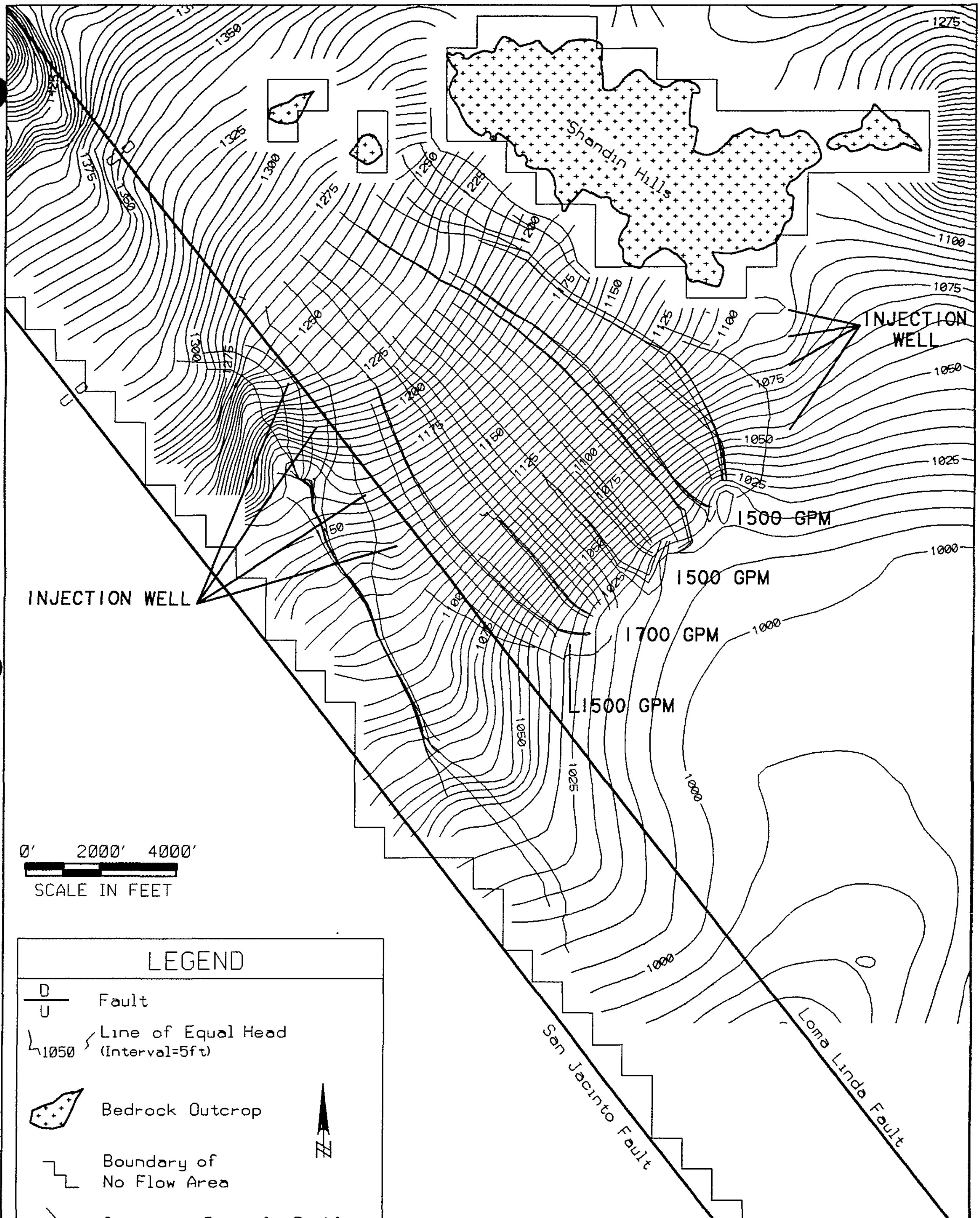

FIGURE 12-16

HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 9
LAYER 1 (UPPER AQUIFER)

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NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE

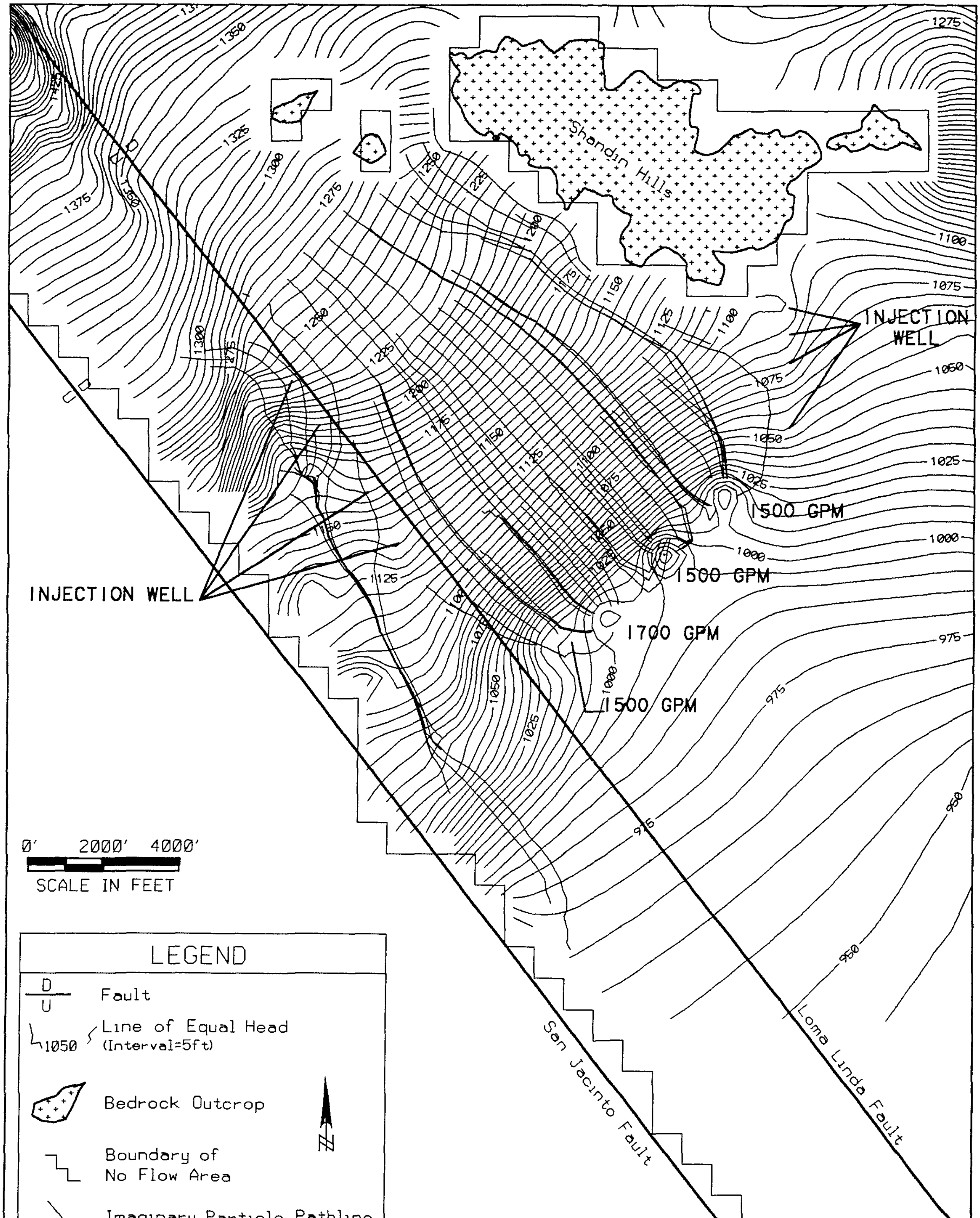

FIGURE 12-17
HEAD CONTOUR AND PATHLINE PLOT
FOR EXTRACTION SCENARIO NO. 9
LAYER 2 (LOWER AQUIFER)

12.2 DEVELOPMENT OF ALTERNATIVES

The following alternatives have been considered for the Muscoy Plume OU:

- Alternative 1 - No Action (Monitoring)
- Alternative 2 - Aqueous-Phase GAC with Municipal End Use
- Alternative 3 - Air Stripping with BACT Off-Gas Treatment with Municipal End Use
- Alternative 4 - Advanced Oxidation (Ozone/Peroxide) with Municipal End Use
- Alternative 5 - Aqueous-Phase GAC with Reinjection

Alternatives 2 through 5 utilize four new proposed extraction wells located between the 19th Street and Baseline Feeder wellfields. An approximate pumping rate of 6,200 gpm will be used at these new proposed extraction wells. A discussion of the selected extraction scenario used for the development of alternatives is presented in Subsection 12.1.5.

The selected extraction scenario was used in combination with each of three treatment alternatives (Aqueous GAC, Air Stripping, and Advanced Oxidation), and with two methods of end use (Municipal End Use and Reinjection). These treatment and end use options can be used in a number of combinations; alternatives presented in this section were chosen based on discussions with the EPA and limited to only those alternatives that were evaluated as most appropriate.

It should be noted that the City of San Bernardino is currently operating an aqueous GAC system at the 19th Street wellfield. Presently, this facility has a flow capacity of 5,600 gpm when operated in parallel, or 2,800 gpm when operated in series. This facility could be modified to accept all extracted water from the proposed extraction wells. Modifications to the GAC system would include the addition of GAC units. If the existing facility can be modified, a reduction in the design and construction schedule and associated costs may be possible. The cost involved in the modification of the existing 19th Street GAC system is discussed under Alternative 2 in Section 13.0. It should be noted that the development of Alternatives 2 and 5, construction of a new GAC plant, to accept the entire water pumped from the proposed extraction wells is considered. This is based on the assumption that the 19th Street GAC system may not be available for modification. The proposed location of the new GAC plant for Alternatives 2 and 5 is discussed in Section 13.0.

For analysis purposes, it was assumed that the City of San Bernardino can accept all groundwater treated by the remedial system into its municipal water supply. For the purposes of this document, all pumping costs and O&M costs are included; however, these costs will be negotiated at a later date with the City and a percentage of the extraction costs may be borne by water supply agencies in exchange for the treated water. Alternative 5 is developed using injection well end use in case the City cannot accept the treated groundwater into the municipal system. Detail of the proposed reinjection well system is presented in Subsection 12.1.

12.3 SCREENING OF ALTERNATIVES

Remedial alternatives were evaluated and screened on the basis of short- and long-term aspects of effectiveness, implementability, and cost as outlined in EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA 1988a). At this stage, the alternatives are only generally evaluated on the basis of the three criteria. The alternatives which survive the evaluation at this step undergo a more thorough and extensive analysis in Section 13. Each screening criterion is discussed below.

Effectiveness - Each alternative is evaluated in terms of its effectiveness in protecting human health and the environment through reductions of toxicity, mobility, and/or volume of the contaminated groundwater. Short-term effectiveness considers risk of exposure during the construction and implementation period; long-term effectiveness considers the permanence of remediation after RA is complete.

Implementability - Implementability measures the technical and administrative feasibility to construct, operate, and maintain a remedial alternative. Technical feasibility refers to availability, and ability to construct, operate, maintain, and monitor the alternative. The alternative's ability to meet regulations until a RA is complete is also considered. Administrative feasibility refers to ability to obtain approvals from other offices and agencies, and availability of treatment, storage, and disposal services. Availability of specific equipment and technical specialists is also considered.

Cost - Absolute accuracy of cost estimates is not essential at this stage of evaluation. Comparative estimates with relative accuracy are required to identify aspects of an alternative that will control cost, based on prior estimates, site-cost experience, and engineering judgement. The cost includes both capital and O&M costs; O&M includes those costs after the remedial action is complete. Potential future RA costs are also to be considered.

12.3.1 Alternative 1: No Action (Monitoring)

The No Action alternative provides a baseline against which other alternatives are evaluated. This alternative includes quarterly sampling and water level monitoring of existing monitor and municipal supply wells.

Effectiveness - The No Action alternative does not satisfy the statutory requirement of protectiveness of human health and the environment, and does not materially reduce potential risk of direct human contact with contaminated groundwater. Because this alternative does not remove or contain contaminants at the site, there is no reduction in toxicity, mobility, or volume. It would not attain the RA objectives of inhibiting migration of the groundwater contaminant plume.

Short-term effectiveness is high because the installation of monitoring wells is a common and safe procedure. Long-term effectiveness is low because residual contaminants are not removed from the aquifer. Proper health and safety (H&S) procedures will be followed when new monitoring wells are installed and during quarterly sampling events to reduce potential health risks during this very limited exposure time.

Implementability - The No Action alternative is technically feasible because continuous monitoring of wells is common practice. Groundwater analysis is available from commercial laboratories, and associated technologies are well established.

Administrative implementability is poor because No Action does not meet the RA objectives by itself. Public and government approval is difficult to attain because there is no remediation.

Cost - The present worth estimated cost for Alternative 1 is approximately $2.2 million, and details are presented in Section 13.0.

Evaluation - The No Action alternative has been retained for detailed analysis as required by the NCP.

12.3.2 Alternative 2: Aqueous-Phase GAC With Municipal End Use

This alternative uses groundwater extraction wells placed ahead of the leading edge of the plume to inhibit plume migration. The location of extraction wells and their pumping rates are shown in Figures 12.10 and 12.11. The exact locations and design of the extraction wells will be developed in the RA. Extracted groundwater will be conveyed through underground piping to the aqueous-phase GAC treatment system. The proposed location of the treatment plant is discussed in Section 13.0. Depending on the quality of the extracted water, pretreatment may be required to remove suspended solids and fine silts. Treated groundwater will be pumped to the municipal water supply system. A schematic process diagram of an aqueous-phase GAC system is shown in Figure 12-18.

Effectiveness - This alternative controls current and potential risks to human health and the environment by reducing the toxicity, mobility, and volume of contaminants. A high degree of effectiveness also results because the system does not produce air discharges and contaminants are removed from the site in the form of spent carbon which is regenerated at an approved facility.

The potential of short-term risks to construction crews and implementation personnel is low because there is only minimal opportunity for direct contact with contaminated groundwater. Handling of spent carbon and the off-site incineration or regeneration process of carbon disposal poses some threat to human health. This can be managed by implementing proper H&S procedures.

Long-term effectiveness is high because contaminants will be removed from the aquifer after implementation of the RA. Only minor residuals may remain in the aquifer after treatment, which are VOCs adsorbed by soil matrix due to organic carbon in the soil.

Implementability - This alternative is highly implementable. It is considered to be a standard remedial approach in the industry and is relatively easy to construct, operate, and maintain. Also, removal and regeneration or incineration of carbon is a common service provided by many vendors.

Administratively, regulatory approval for extraction and treatment systems is expected to be relatively easy to obtain. Acceptance from the City of San Bernardino is required to permit the municipal water supply end-use option. Compliance with any additional requirements, such as a monitoring program, discharge permits, or a remediation progress evaluation may be required.

Cost - The present worth estimated cost for Alternative 2 is approximately $26.0 million, and details are presented in Section 13.0.

Evaluation - The aqueous-phase GAC with municipal end-use alternative has been retained for detailed analysis because of its effectiveness in reducing mobility, toxicity, and volume of contaminants.

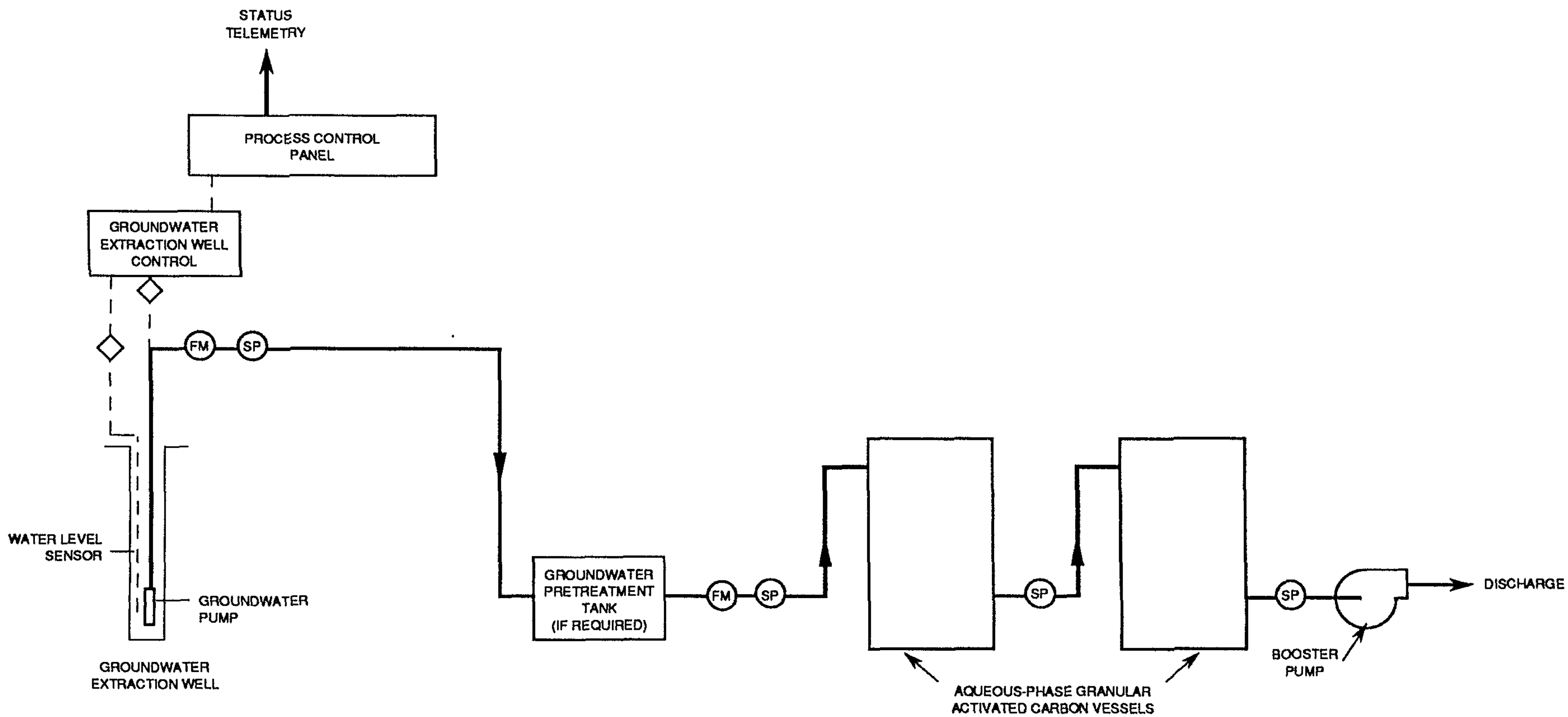

Figure 12-18
Aqueous-phase Granular Activated Carbon System
Conceptual Drawing
Muscoy Plume OU RI/FS Report
Newmark Groundwater Contamination Superfund Site

LEGEND	
SP	SAMPLING PORT
FM	FLOW METER
◇	SYSTEM SHUT-OFF SENSOR

12.3.3 Alternative 3: Air Stripping With BACT Off-Gas Treatment With Municipal End Use

Aspects of this alternative are similar to those of the previous alternative. Groundwater extraction wells are used to extract groundwater. Extracted water is then conveyed through underground piping to the air stripper treatment system. Off gases from the stripper towers are treated using BACT. Because vapor-phase GAC is identified as a BACT for off gas treatment, it will be used for the purpose of this section and detailed analysis in Section 13.0. Treated groundwater is then pumped to the municipal water supply system.

A schematic process diagram of an air stripping system with BACT (or vapor-phase GAC off-gas treatment is shown in Figure 12-19.

Effectiveness - This alternative reduces the toxicity, mobility, and volume of contaminants. The high degree of effectiveness is achieved as a result of vapor-phase contaminants being collected, removed from the site, and destroyed in the carbon regeneration process.

Groundwater potential of short-term risks to construction crews and implementation personnel is low because there is very limited direct contact with contaminated groundwater. Handling of spent carbon and the off-site incineration or regeneration process of carbon disposal poses some threat to human health. This can be managed by implementing proper H&S procedures.

Long-term effectiveness is high because contaminants have been removed from groundwater after implementation of the remedial action. Resulting residuals consist of VOCs adsorbed to organic carbon in the soil.

Implementability - This alternative is highly implementable. It is considered to be a standard remedial approach in the industry and is relatively easy to construct. Maintenance of air stripper and GAC treatment units requires monitoring the control systems regularly to ensure it is operating to full capability. Removal and regeneration or incineration of activated carbon is a common service provided by many vendors.

Administratively, it is typically more difficult to obtain permits for an air stripper system because approval for the off-gas treatment system is required. Acceptance from the City of San Bernardino must be attained to permit the municipal water supply end use option. Compliance with any additional requirements, such as a monitoring program, discharge permits, or a remediation progress evaluation may be required. The necessary equipment and personnel to implement this alternative are available.

Cost - The present worth estimated cost for Alternative 3 is approximately $21.5 million, and details are presented in Section 13.0.

Evaluation - The air stripping with BACT (or vapor-phase GAC) off-gas treatment and municipal end-use alternative will be retained for detailed analysis because of its effectiveness and ease of installation.

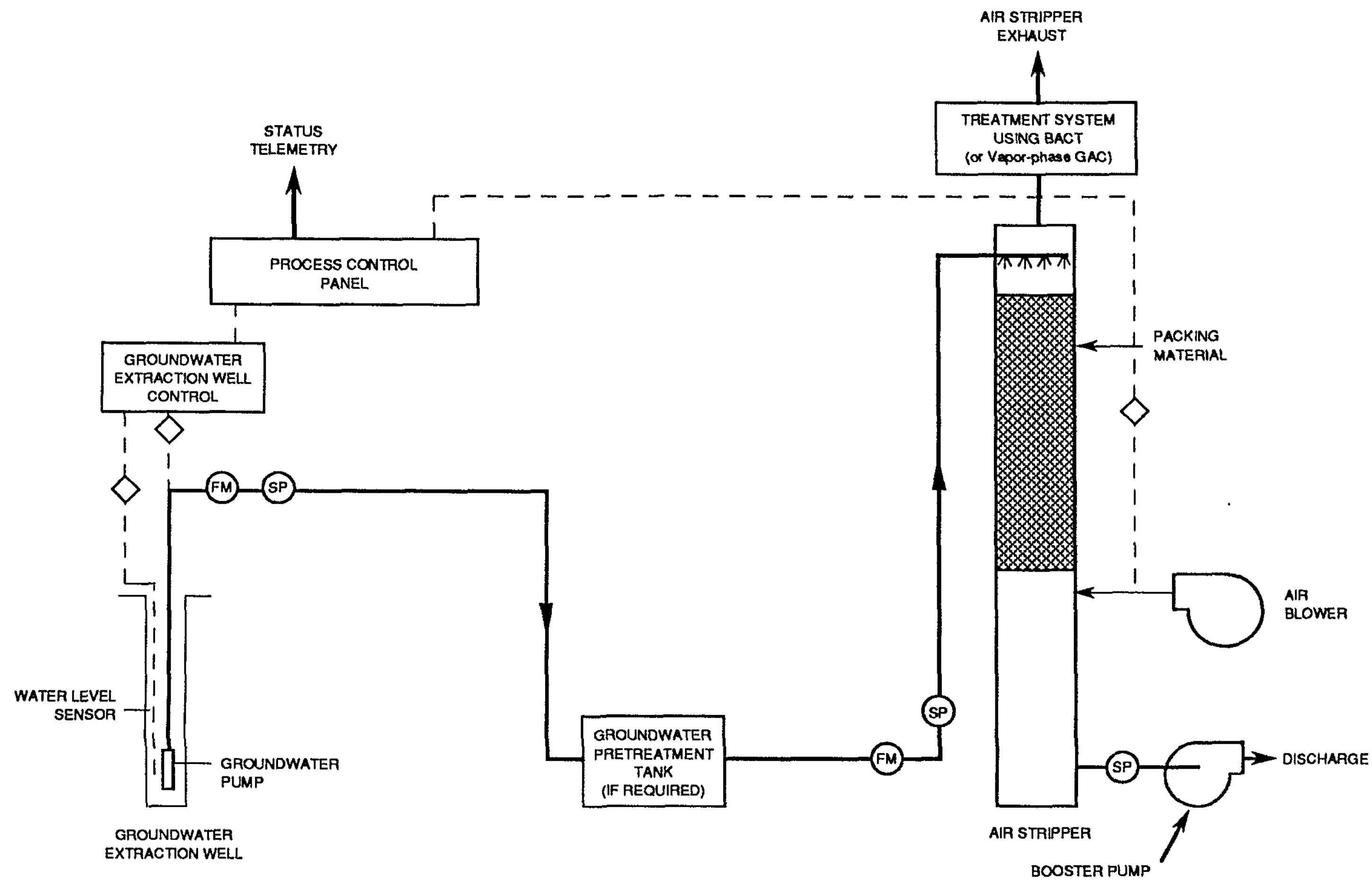

Figure 12-19
Air Stripping With BACT Off-Gas Treatment System With Municipal End Use Conceptual Drawing
Muscoy Plume OU RI/FS Report
Newmark Groundwater Contamination Superfund Site

LEGEND	
SP	SAMPLING PORT
FM	FLOW METER
◇	SYSTEM SHUT-OFF SENSOR

12.3.4 Alternative 4: Advanced Oxidation (Ozone/Peroxide) With Municipal End Use

As with previous alternatives, this alternative includes groundwater extraction wells to pump groundwater through underground piping to an ozone/peroxide advanced oxidation treatment system. Treated groundwater is then pumped to the municipal water supply system. A schematic process diagram of an Advanced Oxidation (Ozone/ Peroxide) treatment system is shown in Figure 12-20.

Effectiveness - This alternative is not a fully proven destructive technology for large systems to reduce the toxicity, mobility, and volume of contaminants. The process can produce hazardous by-products if incomplete oxidation occurs. A high degree of effectiveness is achieved if complete oxidation occurs, whereby contaminants are destroyed and treatment residuals are not produced.

The potential of short-term risks to construction crews and implementation personnel is low because there is a low risk of direct contact with contaminated groundwater. Handling of strong oxidants poses some threat to human health, which can be managed by implementing proper H&S procedures.

Long-term effectiveness is high because contaminants are destroyed on site.

Implementability - This alternative is technically feasible, is considered to be an innovative remedial approach, and is relatively easy to construct. Maintenance of the advanced oxidation treatment unit requires monitoring of the control systems regularly to ensure it is operating to full capability.

Regulatory approval for the treatment system is expected to be difficult for this innovative technology. It is likely that a full scale GAC system would be required as a contingency measure for municipal end use of the treated water. Acceptance from the City of San Bernardino must be attained to permit the municipal water supply end-use option. Compliance with any additional requirements, such as a monitoring program, discharge permits, or a remediation progress evaluation may be required. The necessary equipment and personnel to implement this alternative are available.

Cost - The present worth estimated cost for Alternative 4 is approximately $32.0 million, and details are presented in Section 13.0. The cost does not include use of a GAC system as a contingency for the advanced oxidation system. The actual cost for the GAC contingency may not be known until a treatability study is performed to evaluate the effectiveness of the advanced oxidation system. Nevertheless, the present worth cost may be much higher than $32.0 million if a GAC contingency system is required.

Evaluation - The advanced oxidation with municipal end use alternative has been retained for detailed analysis because of its potential effectiveness in the destruction of contaminants.

12.3.5 Alternative 5: Aqueous-Phase GAC With Reinjection

This alternative is identical to Alternative 2, which includes extraction wells, underground piping, and aqueous-phase GAC system. However, Alternative 5 discharges treated groundwater into injection wells. These wells will be located and screen placement designed based on modeling results presented in Subsection 12.1. Further evaluation can be undertaken during RD.

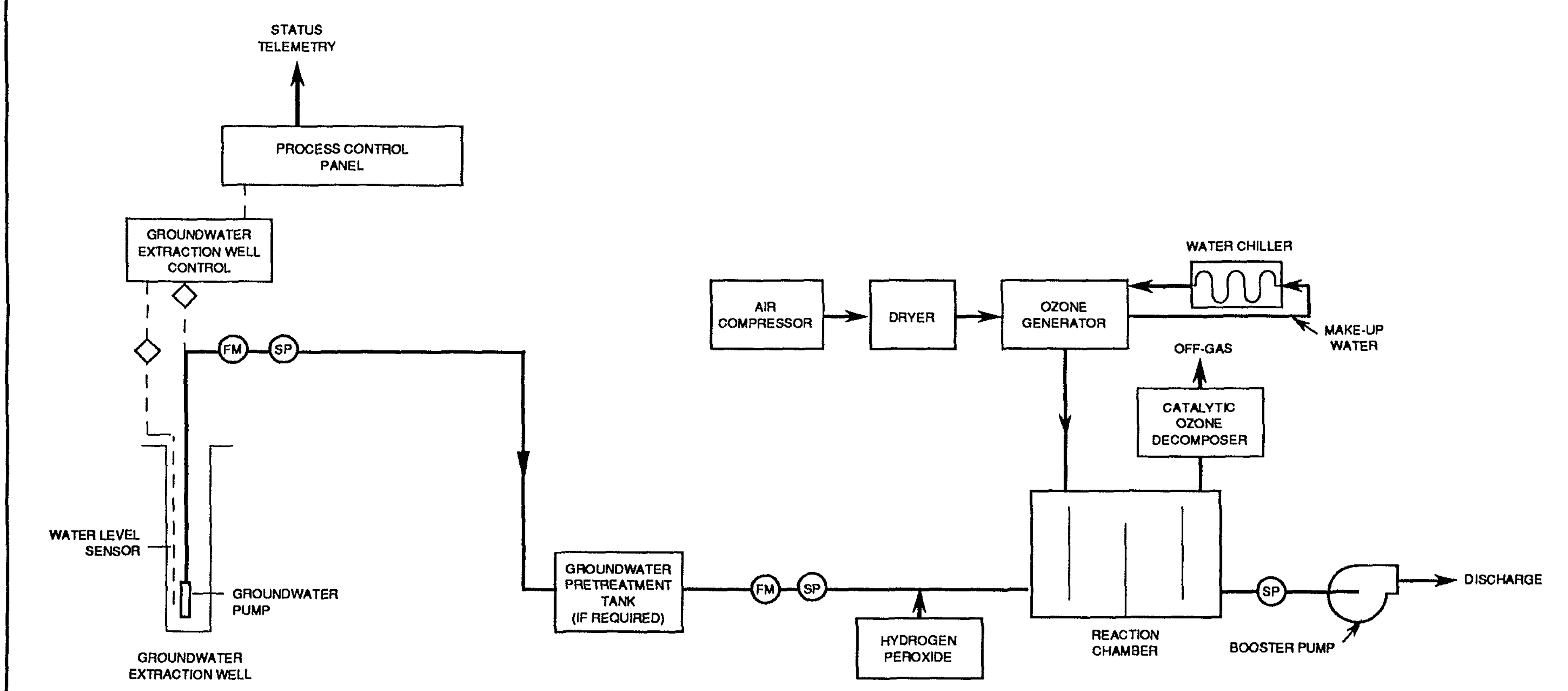

Figure 12-20

Advanced Oxidation System With Municipal End Use Conceptual Drawing

Muscoy Plume OU RI/FS Report

Newmark Groundwater Contamination Superfund Site

LEGEND

- SP — SAMPLING PORT
- FM — FLOW METER
- ◇ — SYSTEM SHUT-OFF SENSOR

Effectiveness - This alternative reduces toxicity, mobility, and volume of contaminants. As with Alternative 2, a high degree of effectiveness results from the system not discharging VOC emissions to the atmosphere and from contaminants being collected and removed from the site during the carbon regeneration process. The injection wells would replenish the groundwater with treated water.

The potential of short-term risks to construction crews and implementation personnel is low because there will be very limited direct contact with highly contaminated groundwater. Handling of spent carbon and the off-site incineration or regeneration process of carbon disposal poses some threat to human health but this can be managed by implementing proper H&S procedures.

Long-term effectiveness is high because contaminants will be removed from groundwater after implementation of the RA, and only minor residuals will remain.

Implementability - This alternative is highly implementable. It is considered to be a standard remedial approach in the industry and is relatively easy to construct and operate. Removal and regeneration of carbon is a common service provided by many vendors. Injection wells typically need additional maintenance to prevent restricted water flow due to plugging or fouling of the wells.

Administratively, regulatory approval for extraction and treatment systems is expected to be relatively easy to obtain. Approval is required for the installation of injection wells used for end use.

Cost - The present worth estimated cost for Alternative 5 is approximately $30.9 million, and details are presented in Section 13.0.

Evaluation - The aqueous GAC with reinjection alternative has been retained for detailed analysis because it provides another effective end-use method if discharge to the municipal water supply is not possible.

12.3.6 Evaluation Summary

Alternative 1, the No Action alternative, will be carried through to detailed analysis, in accordance with the NCP.

Alternatives 2 through 5 inclusive, will also be carried to detailed analysis because all of these treatment systems meet the RA objectives.

Table 12-2 summarizes the results for alternatives evaluated in this section.

Table 12-2

SCREENING OF GROUNDWATER ALTERNATIVES
Muscoy Plume OU

Alternative	Effectiveness	Implementability	Approx. Cost
Alternative 1: No Action	■ Protection of human health and the environment: Poor ■ Reduction of contaminant toxicity, mobility or volume: Poor ■ Short-term: Good ■ Long-term: Good	■ Technical: Excellent ■ Administrative: Poor	$2.2 million
Alternative 2: Aqueous Granular Activated Carbon (GAC) with Municipal End Use	■ Protection of human health and the environment: Excellent ■ Reduction of contaminant mobility, toxicity or volume: Excellent ■ Short-term: Good ■ Long-term: Excellent	■ Technical: Excellent ■ Administrative: Excellent	$26.0 million
Alternative 3: Air Stripping with Vapor Phase Off-Gas Treatment and Municipal End Use	■ Protection of human health and the environment: Excellent ■ Reduction of contaminant toxicity, mobility or volume: Excellent ■ Short-term: Good ■ Long-term: Excellent	■ Technical: Excellent ■ Administrative: Good	$21.5 million
Alternative 4: Advanced Oxidation (Ozone/Peroxide) with Municipal End Use	■ Protection of human health and the environment: Good ■ Reduction of contaminant toxicity, mobility or volume: Good ■ Short-term: Good ■ Long-term: Good	■ Technical: Good ■ Administrative: Poor	$32.0 million
Alternative 5: Aqueous GAC with Reinjection	■ Protection of human health and the environment: Excellent ■ Reduction of contaminant toxicity, mobility or volume: Excellent ■ Short-term: Good ■ Long-term: Excellent	■ Technical: Good ■ Administrative: Good	$30.9 million

Note: None of the alternatives are screened out. All of them are carried through detailed analysis.